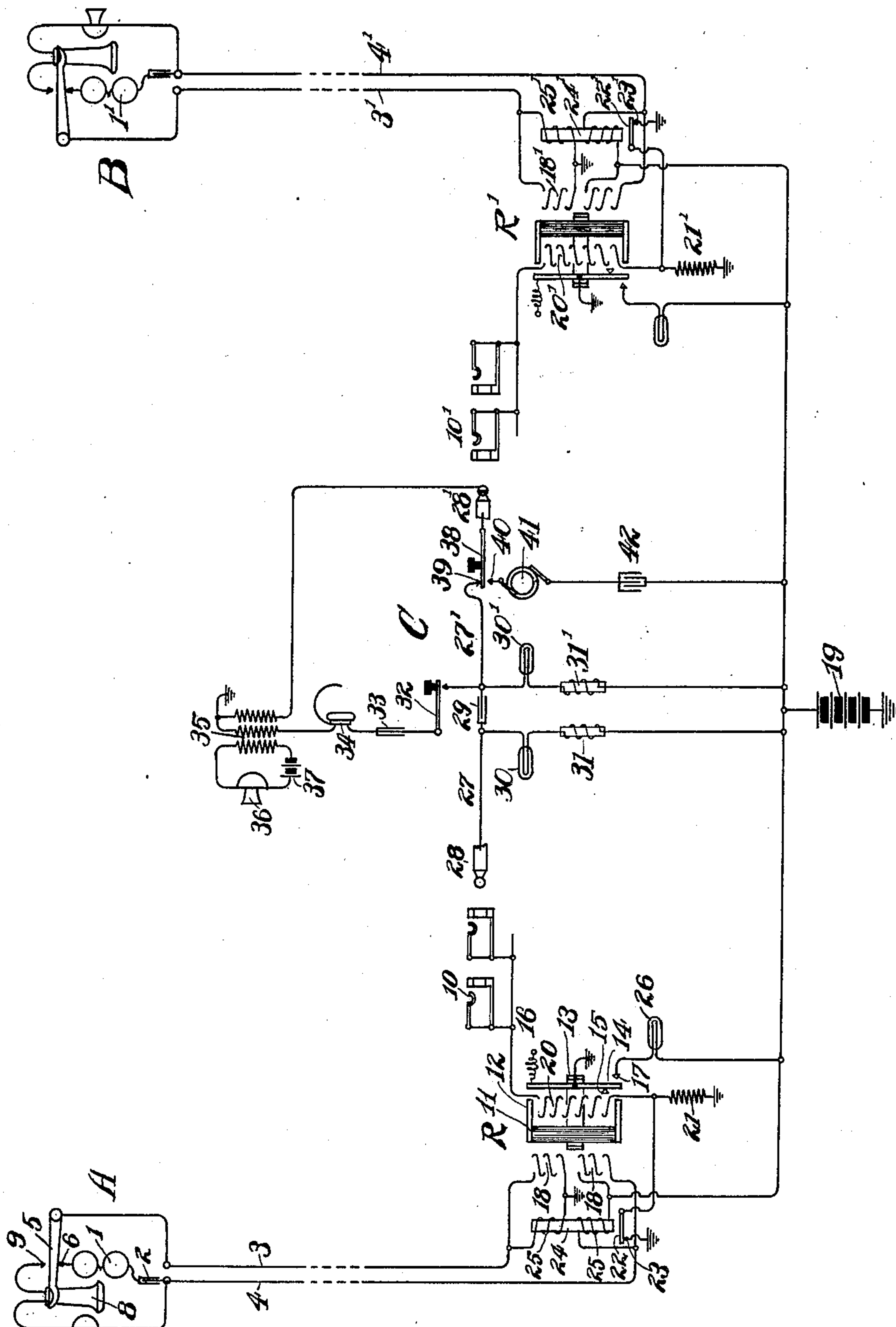


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H. G. WEBSTER.
TELEPHONE SYSTEM.
APPLICATION FILED MAR. 5, 1906.



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TELEPHONE SYSTEM.

No. 897,239.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, HARRY G. WEBSTER, a citizen of the United States, and residing at Chicago, county of Cook, and State of Illinois, have invented new and useful Improvements in Telephone Systems, of which the following is a clear, concise, full; and exact specification.

The present invention relates to manual telephone systems generally, and more particularly to that type in which the various telephone lines, extending to the central office, are inductively united for conversation through the agency of repeating coils, interposed between the lines and their connection terminals, and a link-circuit for conductively interconnecting these terminals.

The principal object of the invention is to provide a system of this type with a novel arrangement of circuits and apparatus for controlling the usual line and supervisory signals.

In carrying out my invention, I associate a polarized repeating coil relay with each telephone line. Each relay through its windings inductively unites the line to its terminals, and by its contacts, controls the line signal. The windings are respectively under the control of the subscriber and operator—the former to energize the relay to cause the attraction of its armature, and the latter to deenergize it to cause the armature to return to its normal position. An additional relay, also under the control of the subscriber, is employed to cut resistance into and out of circuit with the associated line terminals, so as to cause the effacement or allow the display of the supervisory signal upon the connection of the link-circuit to the terminal.

The character of the invention, together with its various features and advantages, will be more fully understood upon reference to the following detailed description taken in connection with the accompanying drawing, and the scope of the invention will be particularly indicated in the appended claims.

In the drawing, which illustrates diagrammatically a telephone system constructed in accordance with the present invention, A and B designate two substations which are connected to the central office C by suitable telephone lines. The equipment at substation A, which may be of any preferred type, is here shown as comprising a call-bell 1 in

series with a condenser 2, included in a normally closed bridge of the telephone line limbs 3—4 by the engagement of the switch-hook 5 with the contact 6. A second bridge, normally open and including the transmitter 7 and receiver 8, is closed at the contact 9 by the switch-hook 5 whenever the receiver is removed therefrom.

At the central office, R designates the polarized repeating coil relay by which the line 3—4 is inductively united to the jacks 10. This relay comprises a soft iron core 11 provided with suitable pole pieces 12 and a permanent polarizing magnet 13 which carries the armature 14, normally held in engagement with the fixed stop 15 by a spring 16, but adapted to engage the contact 17 in response to the energization of the relay. The relay is also provided with two differentially arranged energizing windings. One of these, designated 18, is shown in two sections connected respectively between the opposite poles of the battery 19 and the line limbs 3—4. The other, designated 20, is permanently connected to a circuit extending from the jacks 10 to ground, either by way of the resistance 21 or the non-resistance path including the contacts 22—23 of a control relay 24 under the direct control of the subscriber. This latter relay is provided with the winding 25, shown in two sections, connected respectively between the opposite poles of the battery 19 and the line limbs 3—4, in parallel with the corresponding sections of the repeating coil relay winding 18. The armature 14 is connected to ground, while its contact 17 is connected to the live pole of the battery 19 through the line lamp 26.

The equipment and the connections thus far described with reference to substation A are duplicated in connection with substation B, and the corresponding parts are there indicated by similar primed characters.

At the central office, the link circuit for connecting the jacks 10 and 10' comprises a single strand made up of sections 27—27', uniting the answering and calling plugs 28 and 28' respectively and being conductively separated by a condenser 29, which will permit the passage of voice currents but prevent the passage of current from the battery 19. The supervisory signals, which consist of the lamps 30—30', are connected

each in series with a corresponding impedance 31—31', between the live pole of the battery 19 and the strand sections 27 and 27' respectively. The usual listening key 32 is adapted to complete a branch from the strand section 27' to ground, including the condenser 33, operator's receiver 34 and secondary winding of an induction coil 35. The primary winding of the induction coil is included in a local circuit in series with the operator's transmitter 36 and the battery 37. The induction coil 35 is also provided with a tertiary winding which is included between a tip contact on the calling plug 28' and ground. The strand section 27' is also provided with a ringing key 38 which normally engages the contact 39 to maintain the continuity of the strand, but is adapted to be depressed into engagement with the contact 40 to connect the sleeve contact of the plug 28' to one pole of the calling generator 41, which has its other pole connected through a condenser 42 and the battery 19 to ground.

In the operation of the system, a party at substation A, desiring to converse with a party at substation B, removes his receiver from its hook, and thereby completes a circuit through the winding 18 of the repeating coil relay R. This circuit may be traced from the live pole of the battery 19, through the lower section of the winding 18, line limb 4, the closed bridge at the substation, the line limb 3, the upper section of the winding 18 to the grounded pole of the battery. At the same time, a circuit is completed through the sections of the winding 25 of the control relay in parallel with the sections of the winding 18, so that both the repeating coil relay R and the control relay 24 are energized to attract their armature contacts. The attraction of the armature contact 14 of the repeating coil relay against the tension of the spring 16 closes a path for current from the live pole of the battery 19, through the line lamp 26 to cause its illumination, as a signal to the operator that connection is desired. The attraction of the armature contact 22 of the control relay 24 breaks the normal short circuit about the resistance 21 and brings the latter into effective circuit relation in the branch leading from the jacks 10 through the repeating coil relay winding 20, to ground. Upon observing the call-signal, the operator will insert the answering plug 28 into a jack 10 and depress her listening-key 32 to determine the wishes of the calling party. The act of inserting the plug will close a circuit from the live pole of the battery 19, through the impedance 31, supervisory lamp 30, strand section 27, plug 28, jack 10, repeating coil relay winding 20 and resistance 21, to ground. The completion of this circuit will energize the repeating coil relay in opposition to the energization caused by the winding 18 sufficiently to allow its armature 14 to return to its normal position, thus interrupting the circuit of the line lamp 26 to cause its extinguishment. The current flowing over this circuit, however, will be insufficient to illuminate the supervisory lamp 30 because of the presence of the resistance 21 in circuit. While the listening-key remains depressed, the operator's receiver will be included in a secondary circuit extending from the ground at the repeating coil 35, through the secondary winding of said coil, the operator's receiver 34, condenser 33, listening-key 32, condenser 29, strand section 27, plug 28, jack 10, repeating coil relay winding 20 and resistance 21, to ground. Upon learning the wishes of the calling party, the operator will touch the tip contact of the calling plug 28' against the testing contact of the jack 10' to determine the idle or busy condition of the line. If the line is busy, a potential above that of ground will exist at the testing contact of the jack by reason of its connection through a multiple jack and a connected link-circuit to the live pole of the battery. Consequently, upon touching the tip contact of the plug 28' to the jack, a flow of current will result through the tertiary winding of the induction coil 35, and the usual "click" will be heard in the operator's receiver, as an indication to her that the line is busy. If the line is found to be idle, the operator will insert the calling plug 28' into the jack 10' and depress her ringing-key 38, thereby closing a primary circuit from the grounded side of the battery 19, through the battery, condenser 42, the calling generator 41, ringing-key contacts 40—38, plug 28', jack 10', winding 20' of the repeating coil relay R' and resistance 21', to ground. The alternating current supplied by the generator 41 to this primary circuit will induce a flow of current over a secondary circuit including the other winding 18' of the repeating coil relay, the line limbs 3'—4' and the call-bell 1' to actuate the latter. Before the call is answered by the party at substation B, and after the plug 28' has been inserted, a circuit through the supervisory lamp 30' will exist as follows: from the live pole of the battery 19, through the impedance 31', supervisory lamp 30', strand section 27', plug 28', jack 10', repeating coil relay winding 20', control relay contacts 22'—23' to the grounded side of the battery. By reason of the exclusion of the resistance 21', the flow of current through the lamp 30' will be sufficient to cause its illumination and it will remain in this condition until the call is answered at substation B. Upon this latter event, a circuit will be completed through the windings 25' of the control relay 24', which will energize the latter sufficiently to remove the short circuit from around the resistance 21' and include the latter directly in circuit with the supervisory lamp 30' to cause its extinguishment. With

the parties so connected, the supervisory lamps 30 and 30' will remain dark during conversation, but as soon as either party hangs up his receiver, the corresponding lamp will be illuminated, and the illumination of both lamps will be a signal to the operator to disconnect.

Obviously, the batteries 19 and 37, here shown separately, may be one and the same, and the various ground connections are to be understood as representing, equally well, connections to a common office return. It will be apparent also that certain alterations and modifications may be made in the matter disclosed without departing from the spirit and scope of my invention. I, therefore, do not wish to be limited to the specific disclosure, but aim to cover, by the terms of the appended claims, all such alterations and modifications.

What I claim as new and desire to secure by Letters Patent of the United States is:—

1. A telephone system comprising a telephone line extending from a substation to a central office, a connection terminal for said line, a polarized repeating coil relay having windings inductively uniting said line to said terminal, a signal controlled by the relay contacts, means under the control of the subscriber for energizing said repeating coil relay normally to cause the display of said signal, and means under the control of the operator for modifying said energization to return the relay contacts to their normal relative position.

2. A telephone system comprising a telephone line extending from a substation to a central office, a connection terminal for said line, a polarized repeating coil relay having windings inductively uniting said line to said terminal, a signal controlled by said relay contacts, means under the control of a subscriber for completing a circuit through one of said windings to energize said relay to cause the display of said signal, and means under the control of the operator for completing a circuit through the other relay winding to modify said energization to return said relay contacts to their normal position and thereby efface said signal.

3. A telephone system comprising a telephone line extending from a substation to a central office, a connection terminal for said line, a polarized repeating coil relay having windings inductively uniting said line to said terminal, a link-circuit for making connection to said terminal to establish a conversational circuit, a signal associated with said line, a signal associated with said link-circuit, means operative upon the connection of said link-circuit to said terminal to supply current over a circuit including one of the repeating coil relay windings normally to cause the display of said link-circuit signal, and means under the control of the

subscriber for subsequently returning said relay contacts to their normal position, thereby effacing said signal.

4. A telephone system comprising a telephone line extending from a substation to a central office, a connection terminal for said line, a repeating coil relay having windings inductively uniting said line to said terminal, a link-circuit for making connection to said terminal to establish a conversational circuit, means under the control of the subscriber for energizing said relay to cause a complete movement of its armature from its normal position, said movement being under the sole control of the subscriber, a line signal displayed in response to such movement, a signal associated with said link-circuit, means operative upon the connection of said link-circuit to said line to establish a circuit normally to display said signal, a resistance, and an additional relay under the sole control of the subscriber for including said resistance in said circuit to cause the effacement of said signal.

5. A telephone system comprising a telephone line extending from a substation to a central office, a connection terminal for said line, a repeating coil relay having windings inductively uniting said line to said terminal, a link-circuit for making connection to said terminal to establish a conversational circuit, means under the sole control of the subscriber for energizing said relay to cause a movement of its armature by closing a circuit through one of said repeating coil relay windings, a line signal displayed in response to such movement, a signal associated with said link-circuit, means operative upon the connection of said link-circuit to said line normally to display said link-circuit signal by closing a circuit through the other repeating coil relay winding, a resistance, a second relay having its energizing windings connected in bridge of said telephone line and operative to include said resistance in said link-circuit signal-displaying circuit to cause the effacement of said signal.

6. A telephone system comprising a telephone line extending from a substation to a central office, a connection terminal for said line, a polarized repeating coil relay having windings inductively uniting said line to said terminal, a link-circuit for making connection to said terminal to establish a conversational circuit, means under the control of the subscriber for completing a circuit through one of the repeating coil relay windings to cause a complete movement of its armature, a line signal displayed in response to such movement, a signal associated with said link-circuit, means operative upon the connection of said link-circuit to said line to complete a circuit through the other repeating coil relay winding normally to display said signal, a re-

sistance, and an additional relay under the control of the subscriber for including said resistance in said circuit to cause the return of the repeating coil relay armature to efface said signal.

7. A telephone system comprising a telephone line extending from a substation to a central office, a connection terminal for said line, a polarized repeating coil relay having windings inductively uniting said line to said terminal, a link-circuit for making connection to said terminal to establish a conversational circuit, means under the control of the subscriber for completing a circuit through one of the repeating coil relay windings to cause a movement of its armature, a line signal displayed in response to such movement, a signal associated with said link-circuit, means operative upon the connection of said link-circuit to said line to complete a circuit through the other repeating coil relay winding normally to display said signal, a resistance, and an additional relay having its energizing windings connected in bridge of the telephone line and operative to include said resistance in said link-circuit signal-displaying circuit to cause the effacement of said signal.

8. A telephone system comprising a telephone line extending from a substation to a central office, a connection terminal for said line, a repeating coil relay having differentially arranged windings inductively uniting said line to said terminal, means under the control of the subscriber for supplying current to one of said windings to energize said relay to cause the attraction of its armature, means under the control of the operator for supplying current to the other winding to decrease said energization to allow the armature to fall back, a signal displayed in response to the attraction of the armature and effaced in response to its return.

9. A telephone system comprising a telephone line extending from a substation to a central office, a connection terminal for said line, a repeating coil relay having differentially arranged windings inductively uniting

said line to said terminal, a link-circuit for making connection to said terminal to establish a conversational circuit, means under the control of the subscriber for completing a circuit through one of the repeating coil relay windings, means operative upon the connection by the operator of said link-circuit to said terminal to complete a circuit through the other repeating coil relay winding, means for displaying a signal in response to the closure of the subscriber's circuit and for effacing said signal in response to the additional closing of the operator's circuit, a signal associated with said link-circuit, and means for displaying said signal upon the closure of the said operator's circuit only and for effacing said signal upon the additional closure of said subscriber's circuit.

10. A telephone system comprising a telephone line extending from a substation to a central office, a connection terminal for said line, a repeating coil relay having differentially arranged windings inductively uniting said line to said terminal, a link-circuit for making connection to said terminal to establish a conversational circuit, means under the control of the subscriber for completing a circuit through one of the repeating coil relay windings, means operative upon the connection by the operator of said link-circuit to said terminal to complete a circuit through the other repeating coil relay winding, means for displaying a signal in response to the closure of the subscriber's circuit and for effacing said signal in response to the additional closing of the operator's circuit, a signal associated with said link-circuit, a resistance, means for displaying said signal upon the closure of said operator's circuit, and means actuated by the closing of the subscriber's circuit to include said resistance in said operator's circuit to efface said signal.

In witness whereof, I hereunto subscribe my name this 3rd day of March, 1906.

HARRY G. WEBSTER.

Witnesses:

A. H. DYSON,
GEO. E. MUELLER.